Going Green with Graphs

Brief Overview:

This lesson is for second grade students who have basic computation skills from 0-20. Students need to be able count by 5's and have some prior knowledge of tally charts and bar graphs from their first grade year. Students will be exposed to new vocabulary and introduced to conducting surveys and creating tally charts. Students will create relationships between tally charts and bar graphs by organizing and constructing bar graphs. Students will use the information from the bar graphs to interpret data.

NCTM Content Standard/National Science Education Standard:

Data Analysis and Probability Standard

Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them

- Pose questions and gather data about themselves and their surroundings
- Sort and classify objects according to their attributes and organize data about the objects
- Represent data using concrete objects, pictures, and graphs

Select and use appropriate statistical methods to analyze data

- Describe parts of the data and the set of data as a whole to determine what the data show

Communication Standard for Grades Pre-K–2

Instructional programs from prekindergarten through grade 12 should enable all students to

- Organize and consolidate their mathematical thinking through communication;
- Communicate their mathematical thinking coherently and clearly to peers, teachers, and others;
- Analyze and evaluate the mathematical thinking and strategies of others;
- Use the language of mathematics to express mathematical ideas precisely.

Grade/Level:

2

Duration/Length:

3 days/60 minutes per day

Student Outcomes:

- Students will collect, organize, and display data to make tally charts and bar graphs.
- Students will be able to interpret data contained in a bar graph.

Materials and Resources:

Lesson 1

- Blank chart paper
- Crayons
- Counters (optional for differentiation)
- Video, book or song
  - 7 Big Ideas Episode (website) http://meetthegreens.pbskids.org/
  - "Dear Children of the Earth" by Schim Schimmel (book)
  - "Recycle" by Gail Gibbons (book)
  - "Recycle Reuse Reduce" by Heidi Howe (song)
- Student Resource 1: Scientist Badges printed on 5160 Avery self adhesive address labels
- Student Resource 2: "How Do You Get to School?" tally chart (1 per partner)
- Student Resource 3: Student response sheet (1 per student)
- Teacher Resource 1: Transparency of "How Do You Get to School?" tally chart
- Teacher Resource 2: Transparency of "Who Walks to School?" tally chart (save the completed chart and copy for lesson 2)
- Teacher Resource 3: Transparency of Discussion question

Lesson 2

- Clip board with index cards for anecdotal note taking
- Scissors
- Glue
- Crayons
- Pocket chart (Venn Diagram if possible)
- Sentence strips
- Base ten rods
- Large version of Teacher Resource 2 on chart paper (1 per group)
- Hula Hoops (optional)
- Student Resource 1: Scientist Badges printed on 5160 Avery self adhesive address labels
- Student Resource 4 and 5: Venn Diagram word sort (1 per partner)

- Student Resource 6: Blank bar graph (1 per student)
- Copy of completed Teacher Resource 2 (1 per student)
- Teacher Resource 1 (optional for differentiation)
- Teacher Resource 4: Transparency of discussion question

Lesson 3

- Scissors
- Glue
- Crayons
- Half sheet of paper (1 per partner)
- Student Resource 1: Scientist Badges printed on 5160 Avery self adhesive address labels
- Student Resource 6 (completed from lesson2)
- Student Resource 7: Question Sort (1 per partner)
- Student Resource 8: Pound of Paper Recycled bar graph (1 per student)
- Student Resource 9: Letter Template (1 per student, extras may be needed depending on differentiation)
- Student Resource 10: Award Template (1 per student)
- Teacher Resource 5: Recycling Scenario

Development/Procedures:

Lesson 1
Pre-Assessment

- Ask students: "How could you make a representation of how the children in our classroom get to school?"
- Provide students with time to think about the question
  - Students should be able to list ideas such as, survey, ask, count, graph, list, vote, tally chart, bar graph.
- Tell students to think-pair-share their ideas.
- Share ideas as a class and chart what each set of partners discussed.

Launch

- Show students a video clip, read a book or play a song about helping the environment (listed under materials).
- Tell students they have a special task to complete for the principal. Explain to students that they will become environmental scientists and will need to find out which classes in our school helps keep our environment clean!
  - Give students scientist badges and allow them to write their names on it (Student Resource 1).

Teacher Facilitation/Student Application

- Introduce conducting surveys and creating tally charts by referring to the pre-assessment activity.

    - Using the students' ideas on the chart paper that students came up with, guide students to the conclusion that a survey needs to be conducted
    - Ask students: "What is a survey?"
        - "A survey is gathering information to find out about a topic"
    - Ask students: "Why would a survey be a good tool to use?
        - "We use surveys to find out people's answers to a question. A survey is easy to conduct."
- Ask students, "What different types of transportation do students use to get to school?"
- Create a list of students' ideas.
- Create a tally chart within the class using a transparency of Teacher Resource 1 (Note: this transparency may need to be used on Day 2 for an extension activity).
- Ask "How should we gather information for our survey?
    - Allow students to share their ideas.
    - Students should suggest raising hands or standing up to answer, yes, to the question being asked. Then students should suggest counting and recording the information by making tally marks.
        - Ask: "How do you make a tally mark"
            - (Students should say, "by drawing a single line,")
        - Ask: "How much does a tally represent?"
            - (Students should say, "one.")
        - Ask: "What do you do when you have 5 tallies?"
            - (Students should say, "Draw a tally mark across a set of four tallies.")
- Ask: "Would we be gathering accurate information if a person voted more than once?"
    - Students should say, " No, because you can not get to school two different ways."
- Complete the tally chart as a whole group on the overhead.
- Ask: "Now that we have our tally marks what can we do to find a total count for each way to get to school."
    - (Students should say, "add the tally marks in each section and write a total at the end.")
    - Be sure students are counting tally marks by fives first, then ones.
- Tell students they will be assigned 5 classes (one in each of the other grade levels) to collect data on school transportation.
- Group students into homogenous or heterogeneous groups depending on your preference.
- Assign each group a classroom to visit. There should only be one group visiting a grade.
- Provide students time to collect data using Student Resource 2. Answer key can be found on Teacher Resource 6 a.
- Have students return to class when finished.

- Tell students we are only going to study the results of the students who walk to school because they are helping the environment the most.
  - Have students total their tally marks for students who walk to school.
- As a whole group create a tally chart showing the number of students who walk to school for each grade level on transparency Teacher Resource 2 (Save for the next day and make student copies of the completed chart.).
  - Allow each group to share the data collected.
- Discuss the data collected.
  - Sample question to ask: How many students in grade __ walk to school?
  - Post transparency of Teacher Resource 3 as the last question and write students' ideas at the bottom.

Embedded Assessment

- Provide students with an open-ended question
  - "What conclusions can you make from the "Who Walks to School? " tally chart (Student Resource 3). Answer key can be found on Teacher Resource 6 a.

Reteaching/Extension

- For students who require more assistance:
  - rephrase or explain the assessment question in a one-on-one setting
  - partner students with higher level learners for support
  - allow students to use counters to help count tally marks
- Extension:
  - Have students extend their conclusions on Student Resource 3 by justifying their answer with data from the chart
    - Example: More students in grade 2 walk to school than students in grade 4 because on the graph the bar for grade 2 shows that 8 students walk to school and the bar for grade 4 shows only 3 students walk to school. 8 is greater than 3.

Lesson 2

Pre-Assessment

- Have students work in partners to complete a Venn Diagram sorting game (Student Resource 4 and Student Resource 5). Answer key can be found on Teacher Resource 6 a.
- Students will be given a Venn Diagram and a list of tally chart and bar graph vocabulary words to compare and contrast.
- Provide students time to complete the Venn Diagram by gluing the words where students think they should go
- Partners who finish early will compare their answers with other partners.

Launch

- Distribute scientist badges
- Using a pocket chart (Venn Diagram if possible) and sentence strips, make a class Venn Diagram with students input.

- Students who have words in different areas on the Venn Diagram should justify their answers. As a class they should decide where the word belongs.
- Display the Venn Diagram for the remainder of the lesson.

Teacher Facilitation/Student Application

- Distribute tally chart, "Who walks to school" created yesterday (Teacher Resource 2).
- Review and discuss the tally chart.
- Tell students they are going to create a tally chart using the same information as yesterday by using base ten rods.
- Place students into small groups around the room on the floor.
- Provide each group with a large version of "Who Walks to School?" on chart paper without the tally marks.
- Provide students with pre-bagged base ten rods.
- Allow students to use the base ten rods as tally marks to recreate the chart from yesterday.
- Explain the relationship between tally charts and bar graphs.
- Both have a title, labels, and provide data.
- Model how to push each grade levels' base ten rods together.
- Provide groups time to push rods together for each grade level.
- Rotate the chart paper so the labels are at the bottom.
- The chart should look like a bar graph.
- Ask students what they noticed about the change made to the tally chart and discuss. Possible responses may include:
  - The number stayed the same
  - The base ten rods go up instead of over
  - The categories are the same
  - The information is the same
- Tell students to go back to their seats and provide them with Student Resource 6.
- Go over the parts of a bar graph and the vocabulary.
  - Title
  - X-axis
  - Y-axis
  - Increments
  - Labels
- As a whole group have students label the bar graph using the "Who Walks to School?" tally chart.
- Remind students that a bar graph should always have a zero axis.
- Have students fill in the information for the bar graph independently.
- Discuss and ask students about the bar graph as a whole group.
  - How many students in ____ grade walk to school?
  - Which grade has ___ students walk to school?
  - How many more students walk to school in ____ grade than in ____ grade?

- Show students transparency of Teacher Resource 4 and allow them time to think about the question and share their answers with the class. List student responses on the bottom.
- Revisit the Venn Diagram created in the beginning of class and discuss if changes should be made.

Embedded Assessment

- Take anecdotal notes throughout the lesson activities
- Use a clipboard with index cards labeled with each child's name.

Reteaching/Extension

- For students who require more assistance:
  - Allow students to use the tally chart created with base ten rods to create their own bar graphs.
  - Overlap a pair of hula hoops to create a Venn Diagram for the word sort to help tactical and kinesthetic learners.
- Extension:
  - Put a transparency of Teacher Resource 1 up and have students create a bar graph using the information for the tally chart.
  - Create open ended questions about the bar graph for students to answer.
    - How many more students walked in _____ grade than _____ grade?

Lesson 3

Pre-Assessment/ Launch

- Distribute scientist badges.
- Return the bar graph that students created yesterday (Student Resource 6). Answer key can be found on Teacher Resource 6 b.
- Tell students they can use the bar graph to interpret data by asking questions.
- Explain that interpret means to understand information that is shown.
- Provide each set of partners with Student Resource 7.
- Have students cut out the questions at the bottom of the page.
- Read the questions and have students decided if it is a good or weak question about the bar graph.
- Glue the questions in the good or weak column.

Teacher Facilitation/Student Application

- Discuss what makes a good question (single or multi-step questions that can be answered directly from the data).
- Review where students should record the evaluations of their questions on Student Resource 7
- Answer the questions using the data and have students come to a final conclusion regarding the quality of the question.
- Put up transparency Teacher Resource 5 and read the paragraph to the class.

- Identify and underline the number of pounds for each grade level as a whole group.
- Using the information have each student create a bar graph (Student Resource 8). Answers can be found on Teacher Resource 6 c.
- Make anecdotal notes at this time.
  - Students who are showing difficulty in completing the task will need to be pulled in a small group for assistance
- Group students into partners.
- Tell students to share their bar graphs with one another to check to that the bars drawn display the same information (everyone's bar graph should look the same).
- Tell students to think about what makes a good question. Students should respond with the following characteristics:
  - Can be answered from the data
  - Provides useful information
  - Is single or multi-step
- Have the partners write at least one question about the bar graph on a half sheet of paper. Provide students about 5-10 minutes to construct a question.
- Collect each pairs' questions and mix them together
- Read one question and have students use thumbs up or thumbs down to determine if the question is good or weak.
  - If the question is good, talk about what made it good.
    - "I can look directly at the bar graph and answer the question."
  - If the question is weak, reword or correct the question as a class.

Embedded Assessment

- Place the "Who Walks to School?" (Student Resource 6) and "Pounds of Paper Recycled" (Student Resource 8) bar graphs on the board.
- Ask students to come to a conclusion about which class helps the environment the most.
- Have students write a letter to the principal explaining which classes help the environment the most and explain why by using the data (Student Resource 9 and Teacher Resource 6d). Then allow students to create an award for that class (Student Resource 10).

Reteaching/Extension

- For students who require more assistance:
  - Provide students with question starters such as:
    - Which grade _____?
    - How many pounds _____?
    - How many more _____?
  - Work with a small group when students are constructing the bar graphs.
- Extension:

- Write another letter to the class that was helping the environment the least and explain to the class what they could do to be more helpful using the data (Student Resource 9).

Summative Assessment:

Students will demonstrate the ability to create a tally chart, organize, construct, and interpret a bar graph. Students will use their tally chart and bar graph to answer two questions and construct one question (Student Resource Sheet 11). Answer key can be found on Teacher Resource 6.

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Super Scientist

Super Scientist

Student Resource 1

Super Scientist

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Student Resource 2

Group Member Names _____

_____

How Do You Get to School?

Grade _____

Mode of Transportation	Tallies	Total
Walkers 		
Car Riders 		
Bus Riders 		

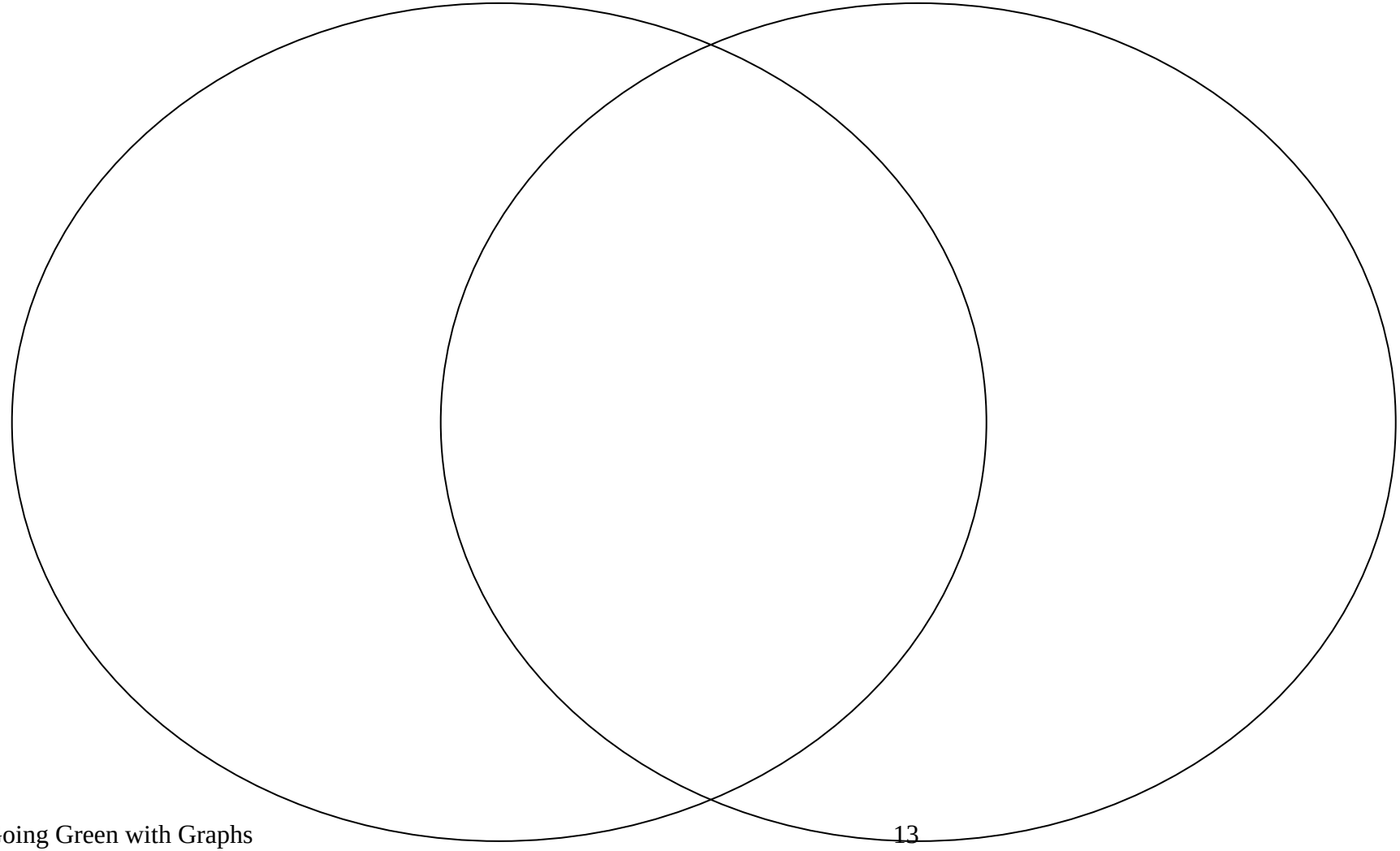
Name _____ Date _____

Look at the "Who Walks to School" tally chart your class made. What conclusions can you make from the chart?

Name_____ Date_____

Tally Chart

Bar Graph



Venn Diagram Vocabulary

Survey	Tally marks	Labels	Title	Axis
Increments	Data	Graph	Information	Counting

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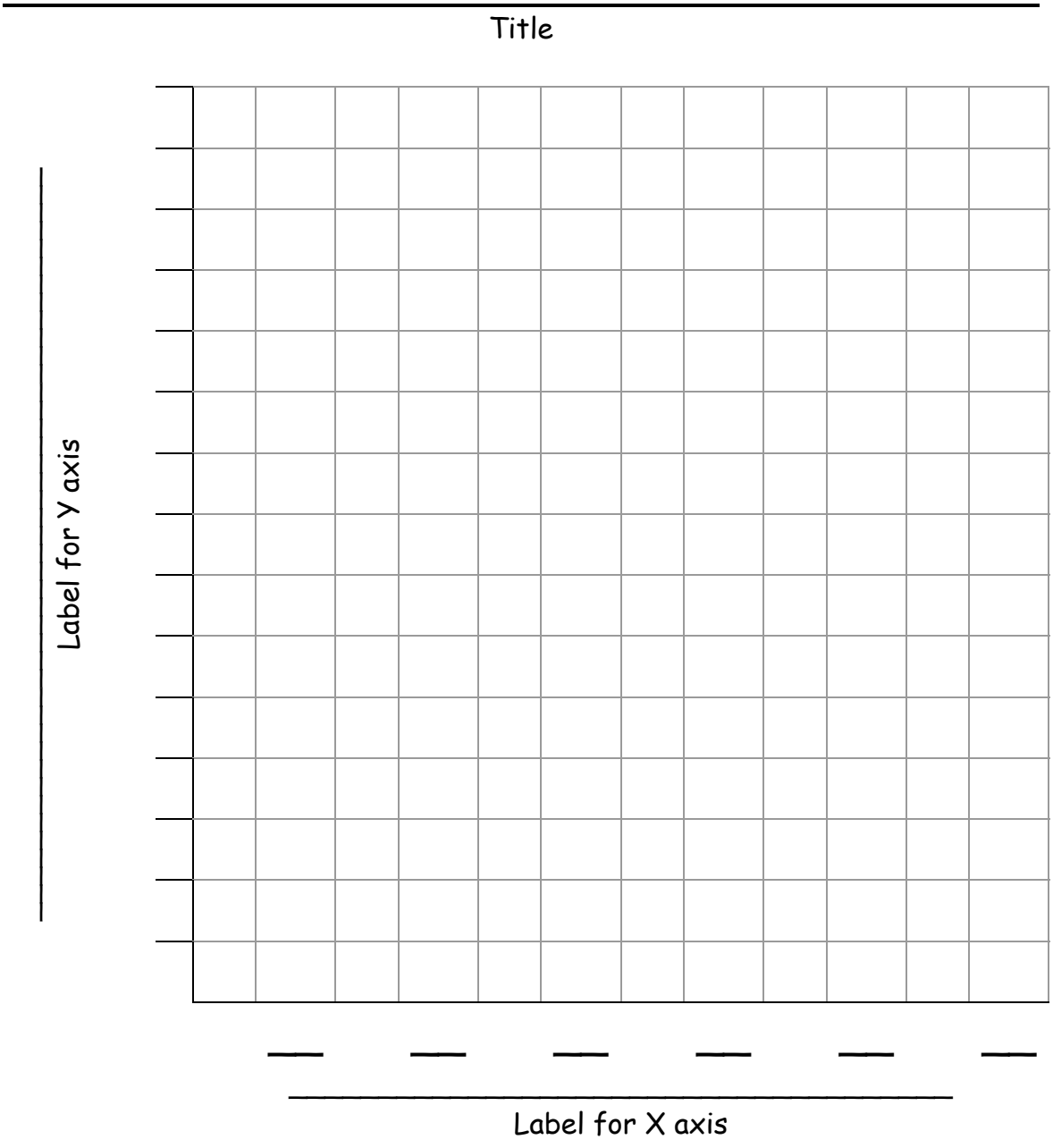
Venn Diagram Vocabulary

Survey	Tally marks	Labels	Title	Axis
Increments	Data	Graph	Information	Counting

Name _____ Date_____

Label the parts of the bar graph with information from the tally chart.



Partner Names _____ Date _____

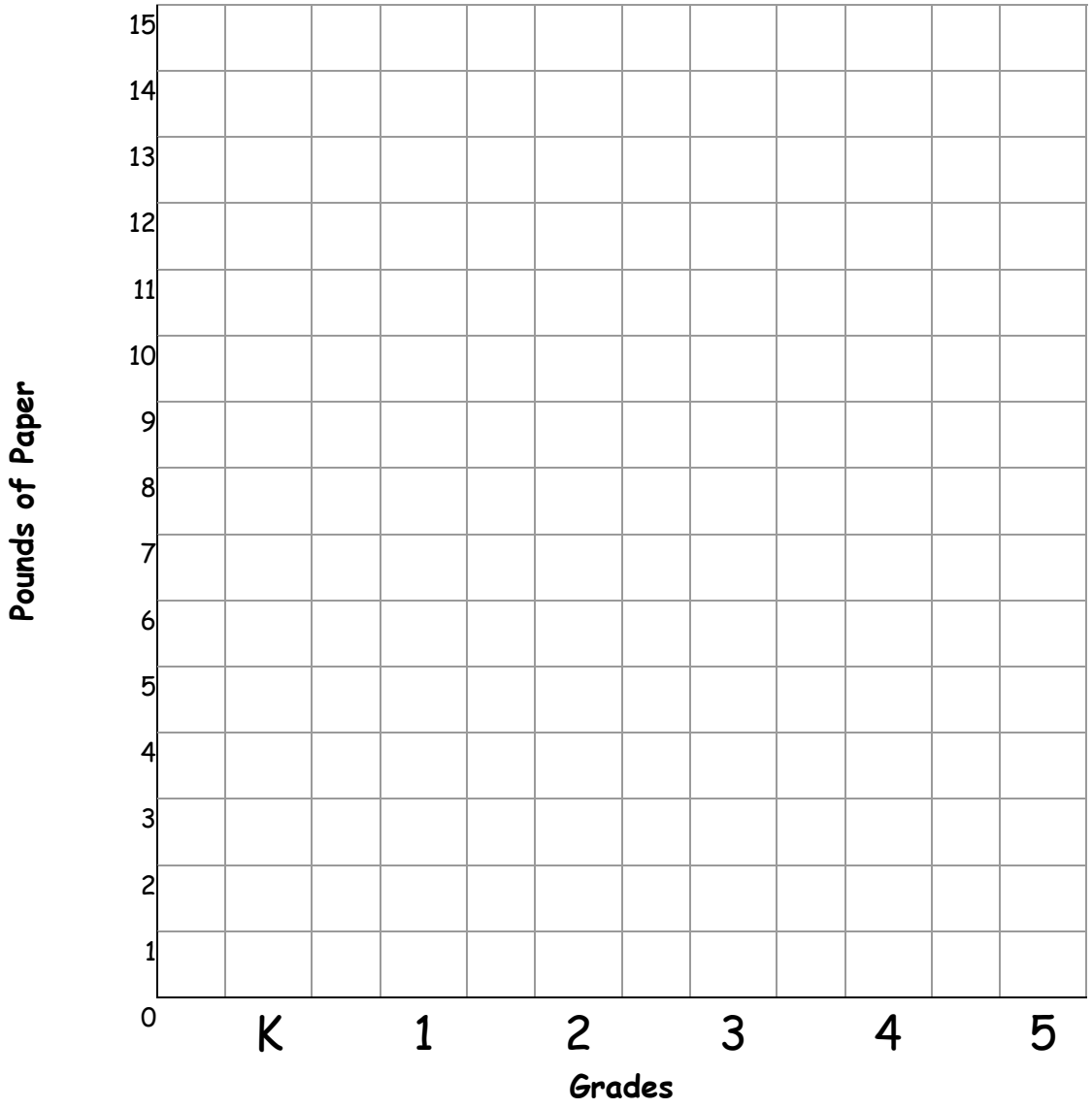
Read the questions below and cut them out. Decide if you think they are good or weak questions to ask about the "Who Walks to School?" bar graph. Glue them into the correct column.

Good Questions	Weak Questions
Why do 4th graders walk to school?	What is the difference between the number of walkers in 1st grade and 5th grade?
Who walks to school?	Which grade has the fewest walkers?
How many more walkers does ____ grade need to be the grade with the most walkers?	Which grade likes walking to school the most?

Name _____ Date_____

Complete the bar graph to show how many pounds of paper each grade recycles.

Pounds of Paper Recycled



Congratulations!

To _____'s Class

For Helping to Save the Environment.

_____ _____

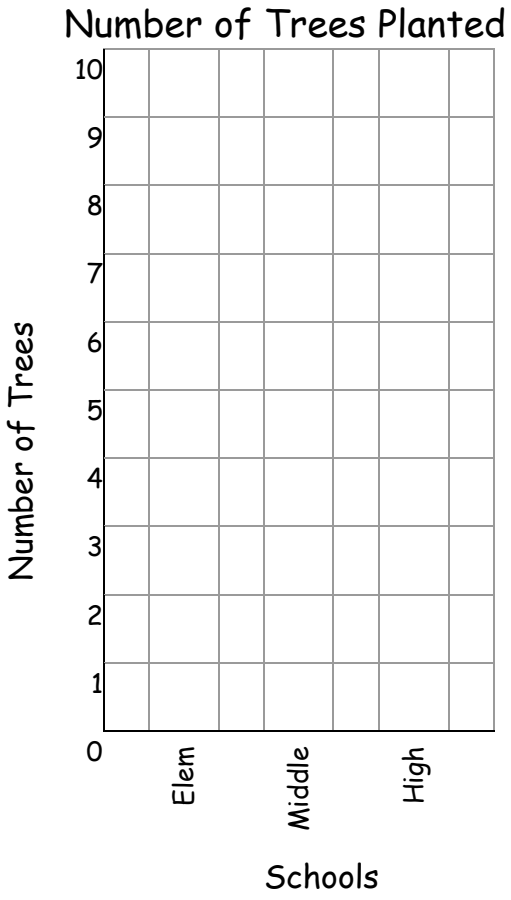
Certified by a Super Scientist Date

Name _____ Date _____

Three schools decided to plant trees to help the environment. An elementary school planted 8 trees. A middle school planted 3 trees. And a high school planted 6 trees.

Using the information in the box fill in the tally chart and bar graph.

Number of Trees Planted	
Elementary School	
Middle School	
High School	



1. How many more trees did the Elementary School plant than the Middle School? _____

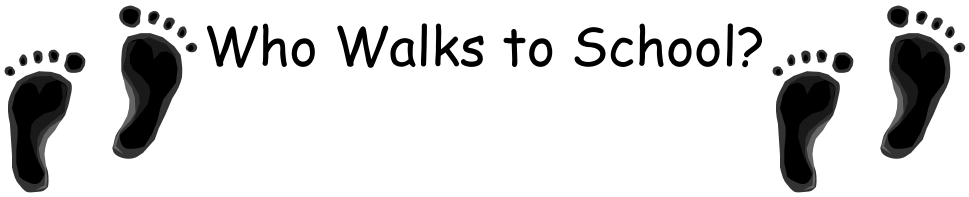
2. How many more trees would the Middle School have to plant in order to have planted the most trees? _____

3. Now you write your own question about the bar graph._____
_____

How Do You Get to School?

Grade 2

Mode of Transportation	Tallies	Total
Walkers 		
Car Riders 		
Bus Riders 		



Grade	Tallies
K	
1st	
2nd	
3rd	
4th	
5th	

Discussion Question

Four car riders in 2nd grade start walking to school. What will the tally chart look like now? How does this change the data?

Discussion Question

If three more tallies are added to _____ grade how will the bar graph change?

Our School Recycles!

Our elementary school is working hard to help the environment by recycling paper. Last week one class in each grade weighed the paper recycling boxes in their classrooms. Kindergarten collected 15 pounds of paper to recycle. First grade's box weighed 4 pounds. Second grade collected 11 pounds. Third grade collected 13 pounds. Fourth grade's box weighed 8 pounds. Fifth grade collected 10 pounds of paper to recycle.

Answer Key

SR2: "How Do You Get to School? tally chart"
Chart will vary depending on your school and grade level. All students should fill in chart with tally marks in groups of 5.

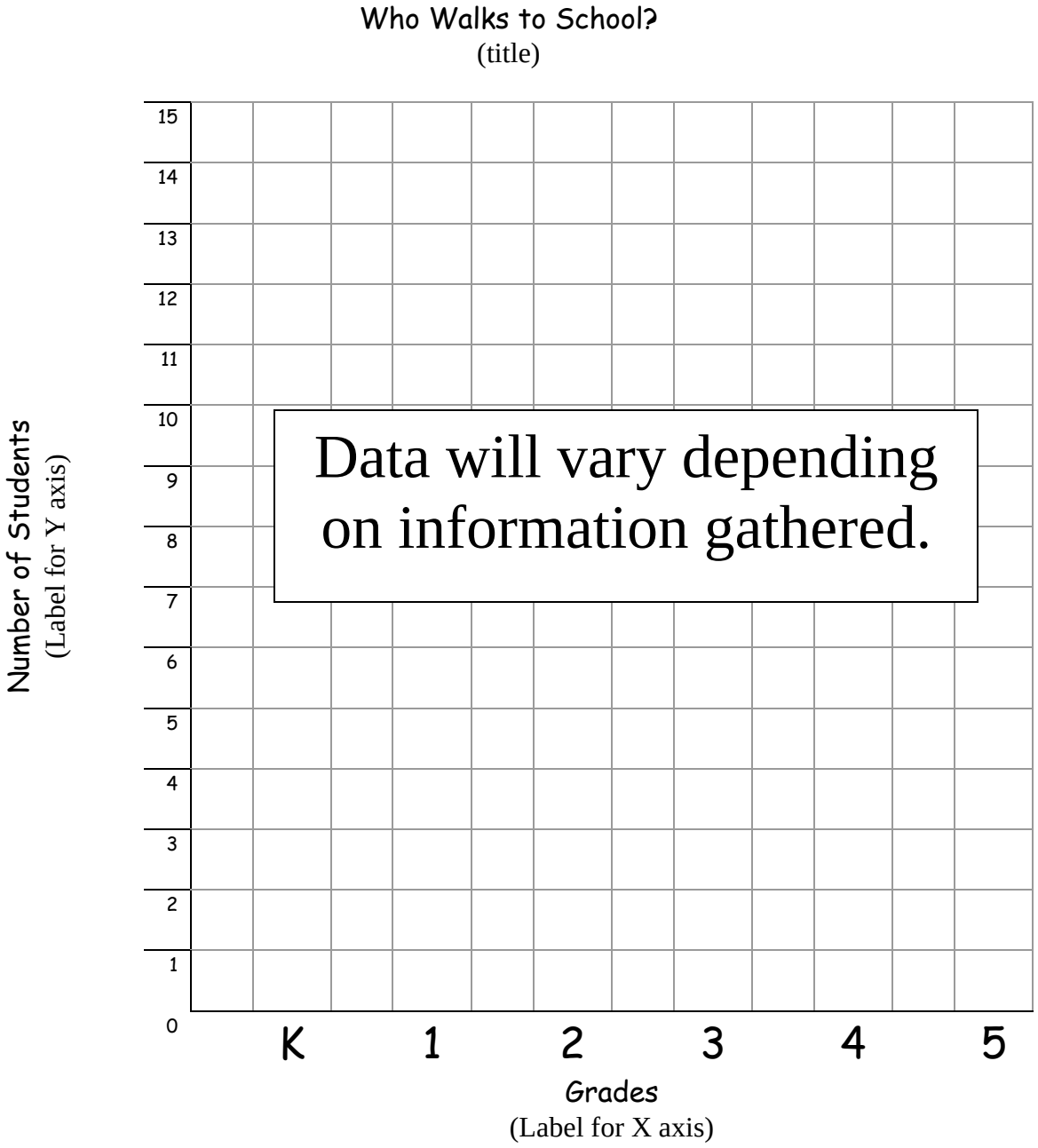
SR3: Question: "Look at the 'Who Walks to School' tally chart your class made. What conclusions can you make from the chart?"
Answers will vary depending on the data. Possible generic responses are listed. If a response can be concluded from the data and is worded appropriate the student should earn a "check plus." If a student responds with an incorrect conclusion he or she earns a "check minus."

- ____ grade has the most walkers.
- ____ grade has the least walkers.
- ____ grade has more walkers than ____ grade.
- ____ grade has fewer walkers than ____ grade.
- ____ grade has ____ more walkers than ____ grade.

SR4: Tally chart and bar graph Venn Diagram

Tally Chart	Both	Bar Graph
Survey Tally marks	Labels Title Data Information Counting	Axis Increments graph

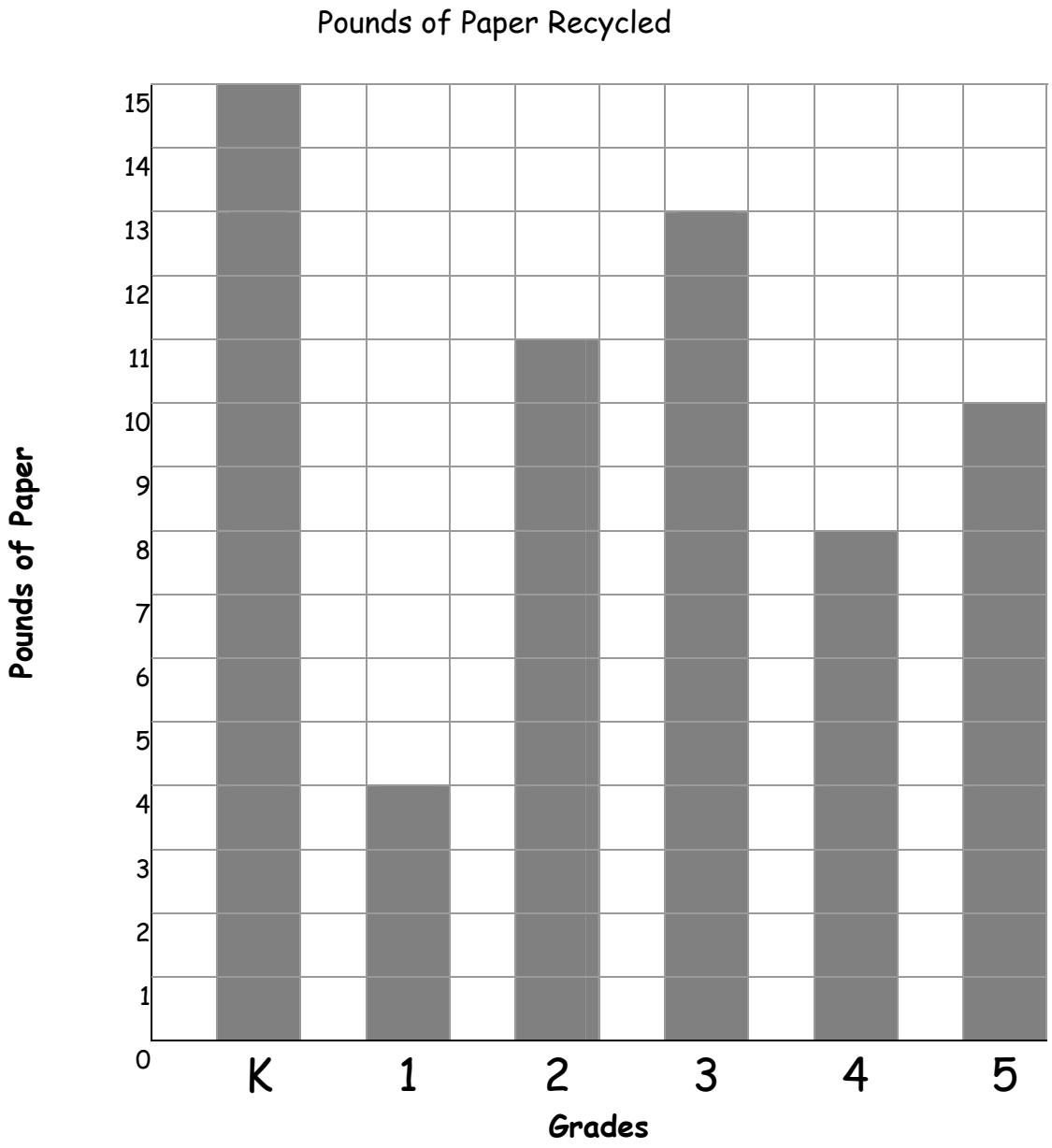
SR6: Label the parts and complete the bar graph



SR7: Good Questions/Weak Questions

Good Questions	Weak Questions
What is the difference between the number of walkers in 1st grade and 5th grade	Why do 4th graders walk to school?
Which grade has the fewest walkers?	Who walks to school?
How many more walkers does ___ grade need to be the grade with the most walkers?	Which grade likes walking to school the most?

SR8: "Pounds of Paper Recycled" bar graph



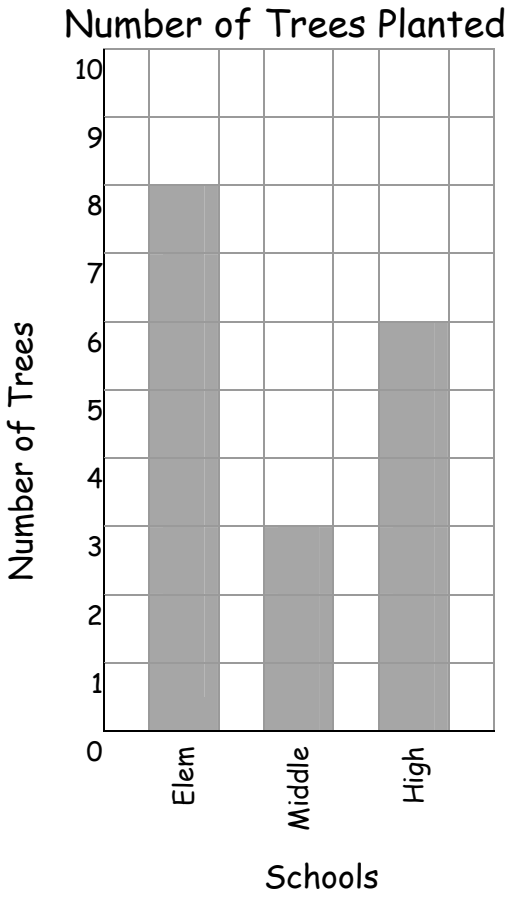
SR9: Letter Rubric

Check plus	• The student states which grade helps the environment the most. • The student cites two reasons to support his/her conclusion using data from the bar graph and/or tally chart. • The student compares data between grades.
Check	• The student states which grade helps the environment the most. • The student cites one reason to support his/her conclusion using data from the bar graph and/or tally chart. • The student does not compare data between grades.
Check minus	• The student states which grade helps the environment the most. • The student cites zero or one reason to support his/her conclusion but does not use data from the bar graph and/or tally chart. • The student does not compare data between grades.

SR11:

Using the information in the box fill in the tally chart and bar graph.

Number of Trees Planted	
Elementary School	𝍸 III
Middle School	III
High School	𝍸 I



1. How many more trees did the Elementary School plant than the Middle School? 5
2. How many more trees would the Middle School have to plant in order to have planted the most trees? 6
3. Now write your own questions about the bar graph. Answers will vary.

TR1: "How Do You Get to School: Grade 2" tally chart

Chart will vary depending on your class.

TR2: "Who Walks to School?" tally chart

Chart will vary depending on the data collected.

TR3: Discussion Question: "Four car riders in 2nd grade start walking to school. What will the tally chart look like now? How does this change the data?"
Answers will depend on data in the tally chart. Students should mention the addition of 4 tally marks to the 2nd grade row. They should also conclude one of two things (depending on what is appropriate for the data:

1. that 2nd grade now has more walkers than another grade.
2. that 2nd grade is still the grade with the most/fewest/2nd most/etc. walkers.

TR4: Discussion Question "If three more tallies are added to _____ grade how will the bar graph change?"
Answers will depend on the grade selected for the "blank" and the data collected. But students should mention that 3 more blocks will be filled in for _____ grade. They should also mention one of two things (depending on what is appropriate for the data:

1. that ____ grade now has more walkers than another grade.
2. that ____ grade is still the grade with the most/fewest/2nd most/etc. walkers.